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ABSTRACT

This earth science guide, for use at the secondary level, is one of a series of guides, K-12, that were developed by teachers to help introduce environmental education into the total curriculum. The guides are supplementary in design, containing a series of episodes (minilessons) that focus on student-centered activities allowing the student to make observations, collect data, interpret results, and draw conclusions. The episodes are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Although the same concepts are used throughout the K-12 program, emphasis is placed on different aspects of each concept at different grade levels or in different subject areas. This guide focuses on aspects such as climatic ecosystems, land use, and atmosphere. Most of the 12 concepts are covered in one of the episodes contained in the guide. Further, each episode offers subject area integration, subject area activities, interdisciplinary activities, cognitive and affective behavioral objectives, and suggested references and resource materials useful to teachers and students. (Author/TK)

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ENVIRONMENTAL EDUCATION GUIDE

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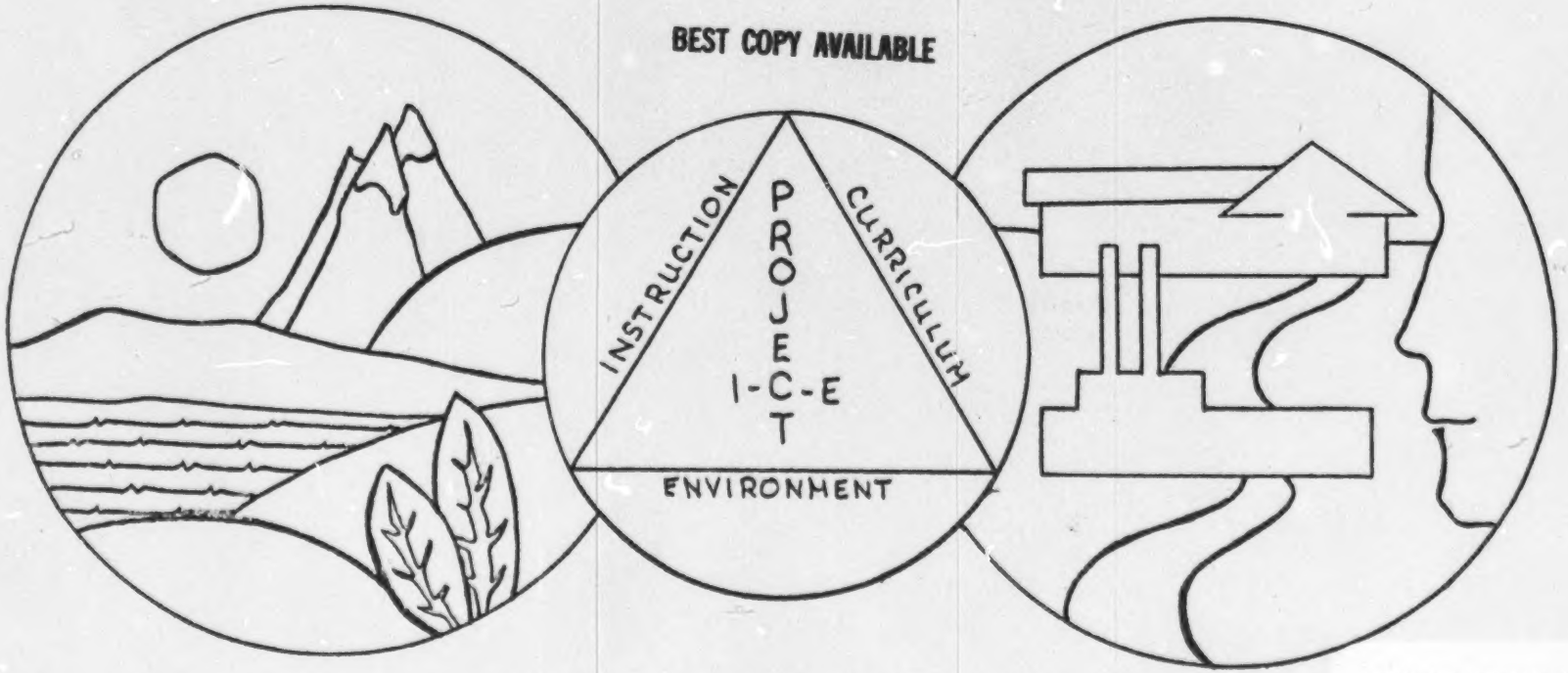

EARTH SCIENCE

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FORWARD TO PROJECT I-C-E ENVIRONMENTAL EDUCATION GUIDES

In 1969, the First Environmental Quality Education Act was proposed in the United States Congress. At the time of the introduction of that legislation, I stated:

"There is a dire need to improve the understanding by Americans of the ominous deterioration of the Nation's environment and the increasing threat of irreversible ecological catastrophe. We must all become stewards for the preservation of life on our resource-deficient planet."

In the three years since the Environmental Education Act was passed by the Congress, much has happened in the United States to reinforce the great need for effective environmental education for the Nation's young people. The intensive concern over adequate energy resources, the continuing degradation of our air and water, and the discussion over the economic costs of the war against pollution have all brought the question of the environmental quality of this nation to a concern not merely of aesthetics but of the survival of the human race.

The intense interest by the public in the quality of our lives as affected by the environment clearly indicates that we cannot just use incentives and prescriptions to industry and other sources of pollution. That is necessary, but not sufficient." The race between education and catastrophe can be won by education if we marshall our resources in a systematic manner and squarely confront the long-term approach to saving our environment through the process of education.

As the incessant conqueror of nature, we must reexamine our place and role. Our world is no longer an endless frontier. We constantly are feeling the backlash from many of our ill-conceived efforts to achieve progress.

Rachel Carson's theme of "reverence for life" is becoming less mystical and of more substance as our eyes are opened to much of the havoc we have wrought under the guise of progress. A strong commitment to an all-embracing program of environmental education will help us to find that new working definition of progress that is a pre-requisite to the continued presence of life on this planet.

- Senator Gaylord Nelson

PREFACE

An understanding of the basic earth processes is a vital part of environmental awareness. To study the natural changes that take place in the earth and the physical environment would seem pointless without a study of man's intervention or the elements.

The children's awareness of the physical environment can be greatly enhanced by their involvement with it. This involvement should be through student-centered activities which allow them to make observations, collect data, interpret results and draw conclusions. The materials we have included in this booklet we hope will meet this objective. As an example of the type of experiences to be found, we have included a unit on natural resources which explores the problem of resource distribution. In this unit the students explore Concept #6 by developing an "Impossible Times Newspaper" through assembling "not likely to happen" headlines and short newspaper type articles. Through their research and self direction, the students will become aware of the problems of conservation and develop recommendations and feelings for the wise use of our natural resources.

The units we have included are not intended to be all inclusive or a total earth science program but only as a supplement to your existing programs.

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DIRECTIONS FOR USING THIS GUIDE

This guide contains a series of episodes (mini-lesson plans), each containing a number of suggested in and out of class learning activities. The episodes are built around 12 major environmental concepts that form a framework for each grade or subject area, as well as for the entire K-12 program. Further, each episode offers subject area integration, multi-disciplinary activities, where applicable, both cognitive and affective behavioral objectives and suggested reference and resource materials useful to the teacher and students.

1. This I-C-E guide is supplementary in design--it is not a complete course of study, nor is its arrangement sequential. You can teach environmentally within the context of your course of study or units by integrating the many ideas and activities suggested.

2. The suggested learning activities are departures from regular text or curriculum programs, while providing for skill development.

3. You decide when any concepts, objectives, activities and resources can conveniently be included in your unit.

4. All episodes can be adapted, modified, or expanded thereby providing great flexibility for any teaching situation.

5. While each grade level or subject area has its own topic or unit emphasis, inter-grade coordination or subject area articulation to avoid duplication and overlap is highly recommended for any school or district seeking effective implementation.

This total K-12 environmental education series is the product of 235 classroom teachers from Northeastern Wisconsin. They created, used, revised and edited these guides over a period of four years. To this first step in the 1,000 mile journey of human survival, we invite you to take the second step--by using this guide and by adding your own inspirations along the way.

PROJECT I-C-E TWELVE MAJOR ENVIRONMENTAL CONCEPTS

1. The sun is the basic source of energy on earth. Transformation of sun energy to other energy forms (often begun by plant photosynthesis) provides food, fuel and power for life systems and machines.

2. All living organisms interact among themselves and their environment, forming an intricate unit called an ecosystem.

3. Environmental factors are limiting on the numbers of organisms living within their influence. Thus, each ecosystem has a carrying capacity.

4. An adequate supply of clean water is essential to life.

5. An adequate supply of clean air is essential for life.

6. The distribution of natural resources and the interaction of physical environmental factors greatly affect the quality of life.

7. Factors such as facilitating transportation, economic conditions, population growth and increased leisure time influence changes in land use and population densities.

8. Cultural, economic, social, and political factors determine man's values and attitudes toward his environment.

9. Man has the ability to manage, manipulate and change his environment.

10. Short-term economic gains may produce long-term environmental losses.

11. Individual acts, duplicated or compounded, produce significant environmental alterations over time.

12. Each person must exercise stewardship of the earth for the benefit of mankind.

A "Concept Rationale" booklet and a slide/tape program "Man Needs His Environment" are available from the I-C-E RMC to more fully explain these concepts.

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Environmental:

Integrated with:

CONCEPT NO. 2 - Ecosystem

SUBJECT Earth Science

ORIENTATION Ecosystem

TOPIC/UNIT Environmental Structure

BEHAVIORAL OBJECTIVES

Cognitive:

Interpret data concerning the interactions of an ecosystem from observations relating to the interaction of an ecosystem. Predict the probable change that will occur in an ecosystem as a result of the introduction of a given factor.

Affective:

Accept the fact that the balance of nature in an ecosystem will be maintained if not influenced by an outside factor. Suggests several possible changes that will occur in an ecosystem when given outside factors are introduced.

Skills Used:

1. Accumulation and organization of data
2. Discussion of the interactions of an ecosystem

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Students should be arranged into small teams to study the physical effects of the ecosystem within an aquarium varying living and non-living parts.
   1. Each team should construct two aquaria of which one will serve as a control while the other will have one variable. Variables will include:
      a. Changing conditions of light, heat.
      b. Increase or decrease of plant or animal life.
      c. Students may suggest other variables.
   2. Students should conduct tests for dissolved oxygen, carbon dioxide, and pH. (Hach Kits or other methods)
   3. Student observations should be made daily for two weeks
      a. Record data
      b. Make charts and graphs
      c. Interpret results
   4. Students should compile their data and findings in a written report.

Outside or Community:

(Continued)

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Books: The Balance of Nature, Miline, Margery, Alfred A. Knopf. New York, N.Y. Standard Methods For the Examination of Water and Wastewater, U. S. Dept. of Public Health. **Audio–Visual:** Conservation & Balance in Nature, (color) 18 minutes, International Film Bureau, BAVI. Field Trip to a Fish Hatchery, 10 min., Coronet, BAVI. Plant-Animal Communities: Ecological Succession (color) 14 min., Coronet, BAVI. **Community:** Resource people Dept. of Natural Resources Fish hatcheries	Classroom: (Continued) A. 5. Class discussion of findings should follow written reports.

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Environmental:

Integrated with:

CONCEPT NO. 3 - Carrying Capacity

SUBJECT Earth Science

ORIENTATION Habitat Determination

TOPIC/UNIT Climatic Ecosystems

BEHAVIORAL OBJECTIVES

Cognitive:

Organize data of a given area into a written report showing the relationship of certain organisms within a region and why they exist there.

Affective:

Question why different environmental conditions have certain organisms associated within it. Gather data concerning climatic regions of the world and the effect of the climate as a limiting factor on the organisms living in that environment.

Skills Used:

1. Research of subject matter
2. Construction of graphs and charts
3. Organization of material
4. Presentation of research material (written and oral)

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Study of climatic conditions in various regions and main organisms associated within those regions.
   1. Desert regions
   2. Tundra regions
   3. Mediterranean region
   4. Equatorial region
   5. Student suggestions for additional regions

B. Students will select a region to investigate. Through the use of charts, graphs, drawings, and collections of data, the student will organize a report showing the interrelationships between climatic conditions and biotic community within the region.

C. Results of student research should show the relationship between environmental conditions and organism habitat.

Outside or Community:

A. Study of local climate conditions and organisms associated with it.
   1. Contact local meteorological agency for climatic information.
   2. Contact local DNR official, forestry expert, wildlife management personnel, or college or university faculty member for information on characteristic local organisms.

B. Do a comparative study of a locality in a foreign country.
   1. Contact embassy of a foreign country for information on climatic conditions and characteristic organisms.

C. Compile a written report comparing regions of study.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Time-Life: Books on environmental regions. **Audio–Visual:** Desert Dweller-Plants and Animals, BAVI. **Community:** Local game management personnel. Faculty members of Universities familiar with regions of the world. Possible exchange students from a region studied.	

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Environmental: Integrated with:

CONCEPT NO. 4 - Water SUBJECT Earth Science

ORIENTATION Water Use TOPIC/UNIT Hydrologic Cycle

BEHAVIORAL OBJECTIVES

Cognitive:

Explain either orally or by written report the water cycle. Analyze statements as to whether a change in a factor will increase or decrease the water available to an area, using his knowledge of the hydrologic cycle.

Affective:

Accept or reject the need to have knowledge about the operation and significance of the hydrologic cycle for everyday living.

Skills Used:

1. Accumulation and organization of data.
2. Discussion of man's use and misuse of water.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Show film, "The Water Cycle."
B. Read and discuss "The Water Cycle" Modern Earth Science, p. 256-259.
C. The students will gather data of water use and water use projections, local water recycling and treatment.
D. Students will then incorporate their data into graphs, charts, and maps and compile a written or oral report to support their understanding of the hydrologic processes.

Outside or Community:

A. Field Trip - water purification plant. Local water sources; investigation of local and state rivers for chemical analysis; general pollution; Water Dept. for water usage--past, present, future.
B. Local Water Dept. officials.
C. Dept. of Natural Resources.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Modern Earth Science, c 1969, Holt, Rinehart, & Winston, pp. 256-259. The Sea Around Us, Excerpts on water's birth. **Audio-Visual:** "The Water Cycle" 10 min. Encyclopedia Brittanica Films, Inc. **Community:** Field trip to any suitable piece of land.	

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Environmental:

Integrated with:

CONCEPT NO. 6 - Resources

SUBJECT Earth Science

ORIENTATION Resource Distribution

TOPIC/UNIT Natural Resources

BEHAVIORAL OBJECTIVES

Cognitive:

Explain why all resources are not found distributed equally over the earth. Describe where he would not likely find a given resource. Explain where and how each resource originated and where it is found throughout the world.

Affective:

Reserve judgment as to whether a given resource could be found in an area until he had additional information.

Skills Used:

1. Use of library for materials.
2. Trying out other sources not used before, such as clubs and societies and their publications.

(Continued)

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Students are to assemble, through research, "not-likely-to-happen" headlines and short newspaper articles concerning a locality in our area for an "Impossible Times Newspaper." The articles could include:
- Oil struck in Green Bay.
- Oconto Falls harvest first orange crop.
- Plants and shrubs buried 10 yrs. ago are being dug as coal today.

Student suggestions:
Suggested areas for student articles:
- Fossil fuels
- Ores, minerals
- Wildlife
- Water
- Recreation and natural resources
- Forests

B. When students have completed their articles they should be attached to a large sheet of paper at the front of the room in the format of a newspaper.

(Continued)

Outside or Community:

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications:	Classroom: (Continued) C. Discuss the newspaper, having students give an explanation of their articles. Each student should, after discussion, know where and how each resource originated and where it is found. Skills: (Continued) 3. Humorous and brief article of the newspaper variety. 4. Use of community resources.
Audio–Visual: Films: Our Vanishing Land, color, 16 min. McGraw-Hill. Our Part in Conservation, McGraw-Hill.	
Community: Library Geology Club Museum Oil companies U. S. Forest Service	

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Environmental: Integrated with:

CONCEPT NO. 6 - Resources SUBJECT Earth Sciences

ORIENTATION Fuels for Energy Production TOPIC/UNIT Natural Resources

BEHAVIORAL OBJECTIVES

Cognitive:

Express orally and by written report, with charts and graphs the effects of natural resources in the form of fuels on our daily lives. Explain why fossil fuels have been used considerably when atomic and solar energies have not. Analyze the statement "Atomic energy use could be the solution to our energy problem."

Affective:

Suggest that available fossil fuel sources are rapidly being depleted and a substitute must be found which will fulfill future needs but must also be relatively pollution-free. Advocate the reduction of non-essential travel and energy use as the best way to reduce the energy crises at the present time.

Skills Used:

1. Accumulating comparative data.
2. Analysis of statistical data.
3. Discussion of environmental effects of power sources.

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Students, in small groups, will develop a comparative chart showing the usage of an energy source at present rates and rates of ten years ago. Concentrations should be in the following areas:
   1. Coal
   2. Petroleum
   3. Natural gas
   4. Atomic energy
   5. Solar energy

B. Through research, the students can develop a comparative chart showing availability of the energy sources now and ten years ago.

C. An additional comparative chart can be developed to show projections of population and industrial growth and power needs for the future.

D. The student groups should, through a written report, recommend replacements for those fuels which are in danger of complete depletion.

E. A spokesman for each group will then present his energy research and recommendations to the class in the form of an oral report.

Outside or Community:

A. Panel discussion with guest speakers and students.
   1. Discussion research based upon comparative study and additional research pertaining to fuel-source pollution potentials.

B. Class visit to nearby power plant.
   1. Emphasis on pro - con of nuclear power.
   2. Do present gains of nuclear power outweigh potential pollution problems?

C. Student suggestions after in-class activities.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Earth Science, Brown, Kemper, Lewis, Silver Burdett Company, Morristown, N. J., 1970 566 p. The Earth: Its Changing Form. Beck, P. F. Strahler, A. D., Harcourt, Brace, & World, 1970, 598 p. Conservation, American Petroleum Institute, School Programs, 1271 Avenue of the Americas, New York, N. Y. 10020, 1970. 30 Basic Speech Experiences, Clark Publishing Company. **Audio-Visual:** **Community:**	

Environmental:

CONCEPT NO. 7 - Land Use

ORIENTATION Research of local land use

Integrated with:

SUBJECT Earth Science

TOPIC/UNIT Land Use

BEHAVIORAL OBJECTIVES

Cognitive:

Apply the principles of research in analyzing the soil, water, air, and geographical features of a given area to discover how each influences the land use. Predict the change in land use that will probably result from a given change in one of the factors above.

Affective:

Attempt to illustrate that land conditions determine usage and will influence where people live.

Skills Used:

1. Collecting data
2. Organization of materials
3. Map making
4. Graphs and diagrams

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Research on Land Use of the Area.
   1. Use for recreation
   2. Use for roads
   3. Residential uses
   4. Commercial and industrial use
   5. Food growing

B. Use research material to show increase in the last 20 years.
   1. How the land area uses have changed
   2. How food production has increased; reasons for increased production.

C. Population research
   1. Change of population centers.
      a. Land use changes from farming to residential and commercial/industrial use.
      b. Access from rural to urban areas with road building.
      c. Soil depletion and land clearing.

(Continued)

Outside or Community:

A. Students will select one aspect of the area to investigate such as:
   1. Soil
   2. Geological features
   3. Air
   4. Water

B. Each aspect of the area investigated will relate to the effects on the community such as:
   1. Population changes
      a. Industry
      b. Food related and producing

C. Resource people
   1. Local agriculture agent
   2. Water and air quality expert from the state department
   3. Dept. of Natural Resources
   4. Personnel from local university familiar with local land formations.

SUGGESTED RESOURCES

Publications:

Asimov, Isaac. Building Blocks of the Universe. Abelard-Schuman, Ltd., New York. 1957.
Asimov, Isaac. The Search for the Elements. Basic Books, Inc., New York. 1962.
Meyer, Jerome S. The Elements: Builders of the Universe, World Publishing Co., New York. 1957.
Kane, Henry B. The Tale of a Meadow, Alfred A. Knopf, Inc., New York. 1959.

(Continued)

Audio-Visual:

Conserving our Soil Today, 11 min., Coronet 1960, Environmental Studies, BAVI.
Heritage We Guard, 31 min., USDA 1940, Environmental Studies, BAVI.
Masters of the Soil, 23 min., Ethyl 1948, Environmental Studies, BAVI.
Man Uses and Changes the Land, 11 min., Coronet 1967, Environmental Studies, BAVI.

Community.

CONTINUED OR ADDED LEARNING ACTIVITIES

Classroom: (Continued)

D. Research on land, air, water, geological conditions
   1. Land (Soil)
      a. Mineral conditions
      b. Soil types
      c. Plant growth in types of soil
      d. Soil conditioning
   2. Air
      a. Pollutants
         i. Industrial ii. Natural iii. Sanitary burning
   3. Water
      a. Rainfall b. Runoff c. Ground water
      d. Rivers, streams, lakes (pollution of)
   4. Geological conditions
      a. Natural land features
         i. Valley ii. Hills iii. Plains iv. Rock formations (red rock, types of rocks, soil depth)

E. Research:
   1. Investigate and observe types of rocks and soils
   2. Investigate minerals and their concentration in soils
   3. Use soil testing kits for evaluation
   4. Use water analysis and air quality kits
   5. Rock samples for identification
   6. Students keep data on investigations
   7. Make graphs and charts of data
   8. Use diagrams for soil layers and land formations
   9. Students make oral and written presentations

Publications: (Continued)
Watts, Mary T. Reading the Landscape: An Adventure in Ecology. The MacMillan Co., New York, 1957.
Stallings, J. H. Soil: Use and Improvement. Prentice-Hall, Inc. Englewood Cliffs, N. J. 1957.
Williams-Ellis, Annabel. Man and the Good Earth. G. P. Putnam and Sons, New York, 1959.
I-C-E Field Activity Guide, Land Use - A Simulation Activity.

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

CONCEPT NO. 9 - Management

SUBJECT Earth Science

ORIENTATION Agricultural Soil Conservation

TOPIC/UNIT Land Use

BEHAVIORAL OBJECTIVES

Cognitive:

Compare good and poor soil management practices through written and oral reports. Analyze a given area to determine whether or not good soil management is practiced. Plan a soil management program for a given area which incorporates the principles of good soil management.

Affective:

Advocate the necessity of the techniques of soil conservation.

Skills Used:

1. Accumulating data
2. Evaluating
3. Expressing
4. Drawing
5. Comparison

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. After reading Modern Earth Science, pp. 242-252 and other reference sources on earth changing forces, students should write reports and make drawings or photographic records of farming land use comparing good and poor land uses.

B. A stream table may be used to show aspects of soil depletion and erosion.

Outside or Community:

A. On a field trip to a nearby farming area, the students will observe and make a pictorial or photographic record of the following farm practices:
   1. Contour plowed field
   2. Tilled field
   3. Strip cropping
   4. Terracing
   5. Crop rotation
   6. Soil testing
   7. Depletion of soil

B. Have county agriculture agent or State Conservation Warden come to class and give talks regarding the area the class is studying.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Modern Earth Science, pp. 242-252, Holt, Rinehart & Winston, c. 1969. **Audio–Visual:** Filmstrip: How Man Destroys Soil, Society of Visual Education, Inc. 1345 Diversey Parkway, Chicago, Illinois 60614 **Community:**	

E. S. E. A. Title III – PROJECT I-C-E 59-70-0135-4

Environmental:

Integrated with:

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CONCEPT NO. 10 - Economic Planning

SUBJECT Earth Science

ORIENTATION Land Use

TOPIC/UNIT Soil Conservation

BEHAVIORAL OBJECTIVES

Cognitive:

Explain in writing or orally, how water and soil loss occurs in areas under over-production, inadequate water and soil controls. Evaluate the use of additional fertilizer on cropland to increase the yield of a crop and the pollution that may result.

Affective:

Promote the necessity for the use of soil conservation techniques to utilize the maximum water available from precipitation. Reserve judgment on the value of additional fertilizer on a given area for additional crop yield.

Skills Used:

1. Use of stream table
2. Chemical analysis
3. Cause and effect

STUDENT-CENTERED LEARNING ACTIVITIES

In-Class:

A. Film: Erosion: Leveling the Land.
B. Readings: Modern Earth Science, pp. 242-252.
C. Investigation: Activities for Modern Earth Science, 11-2.

Outside or Community:

A. Stream pollution
B. Soil pollution:
   1. Chemical
   2. Misuse - poor management
C. Over-production
   1. Plant
   2. Animal
D. Water table determinations.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Modern Earth Science, c. 1969, Holt, Rinehart & Winston, pp. 242-252. Activities for Modern Earth Science, Erosion and Conservation of Soil, 11-2. **Audio-Visual:** Film: Erosion: Leveling the Land, Encyclopaedia Britannica, Inc. **Community:** Field trip to any suitable area showing erosion and erosion control. Local Agricultural Agent. Department of Natural Resources.	

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 11 - Individual Acts

SUBJECT Earth Science

ORIENTATION Air Pollution

TOPIC/UNIT Atmosphere

BEHAVIORAL OBJECTIVES

Cognitive:

Write a paper and give an oral presentation to explain how man has polluted the atmosphere through poor environmental controls. Identify several sources of air pollution in the community.

Affective:

Participate in an anti-pollution campaign in his area. Accept the responsibility of the individual in improving air quality.

Skills Used:

1. Learn to use materials for analyzing air.
2. Organize a presentation written or oral.
3. Cause-effect thinking skill.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. View filmstrip, Canopy of Air.
B. Read Modern Earth Science, pp. 412-415 and The Unclean Sky.
C. Organize a written and oral presentation on "How man has polluted the atmosphere through poor environmental controls."
D. The student should give recommendations for personal and practical action which they could take as individuals to aid in improving air quality.

Outside or Community:

A. Students can make a list of air pollution sources within their community.

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Modern Earth Science, 1969, Holt, Rinehart & Winston. The Unclean Sky, Doubleday, 1967. **Audio–Visual:** Canopy of Air, Filmstrip, Life. **Community:** Department of Natural Resources	

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E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental: Integrated with:

CONCEPT NO. 11 - Individual Acts SUBJECT Earth Science

ORIENTATION Shorelines TOPIC/UNIT Conservation

BEHAVIORAL OBJECTIVES

Cognitive:

Write and illustrate with drawings the processes involved in wave erosion and its impact on the shoreline. Analyze a given area having shoreline erosion control to determine its probable effectiveness.

Affective:

Propose ways to preserve shorelines in his immediate area.

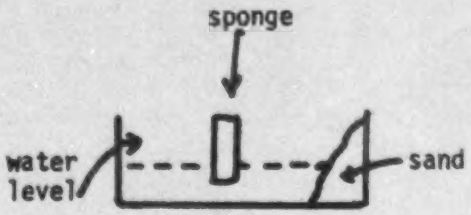
Skills Used:

1. Collection of data and evaluation of data.
2. Illustration of concepts in written and pictorial forms,

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Filmstrip: Evolution of Shorelines.
B. Readings: Modern Earth Science.
C. Activities:
The following activity will enable students to investigate the effects of wave action on a shoreline.
1. Pack sand in a high-sided pan or plastic box and carefully add water as shown in the diagram below.



2. The sand pile should be marked with a grease pencil.
3. Place a sponge in the water and gently move back and forth to produce a constant wave action on the sand bank.

(Continued)

Outside or Community:

A. Shorelines
1. Unprotected erosion
2. Illustrate methods in use for preserving shorelines.
B. State Conservation Department (D.N.R.) and Federal Soil Conservation Department.
1. Resource persons can discuss methods currently in practice for shoreline erosional control.

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SUGGESTED RESOURCES

Publications:

Modern Earth Science,
Holt, Rinehart & Winston, c 1969.
pp. 300-305.
Interaction of Earth and Time,
Rand McNally.

Audio-Visual:

Filmstrip:
Evolution of Shorelines,
E. Shapiro and Company
43055 Kissena Blvd.
Flushing, New York 11355.

Community:

Field trip to suitable area:
i.e., Lakeshore or river bank.

CONTINUED OR ADDED LEARNING ACTIVITIES

Classroom: (Continued)

C. 4. The students should make observations of the changes and record their findings in pictoral form.
5. Water level could then be lowered and new profile marked and wave action continued. The resulting profile should then be recorded by the student.
6. Students should then include with their pictures a written description of their observations.
7. Included in the students' report should be research on shorelines and proposals for shoreline conservation practices.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 11 - Individual Acts

SUBJECT Earth Science

ORIENTATION Land Use

TOPIC/UNIT Environmental Change

BEHAVIORAL OBJECTIVES

Cognitive:

Predict the changes that will probably occur in the future for an area under study given an opportunity to observe and measure environmental factors. Analyze a given environmental change to determine whether it is a natural or man-made change.

Affective:

Recommend a beneficial change in a given area of the environment.

Skills Used:

1. Project selection and formulation
2. Project revision
3. Recording, interpreting and reporting of results
4. Inflicting of beneficial change on an environment.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Class resource-research
   1. Students will select any area of study and will decide what aspect of their environment they want to examine.
   2. Students will submit for approval a proposal stating the scope and content of their project.
   3. Upon approval of their proposal the students will compile research and data and develop an outline.
   4. From their outline, the student will compile a finished report.

Outside or Community:

A. Students and teachers will plan together to invite only those outside speakers that the students feel may offer significant information pertaining to their particular projects.

B. Speakers will confine their discussions to matters of importance to the seminar groups.

C. Outside resources will depend upon selected area of study. They may include:
   1. Comprehensive study of inflow and outflow of a small pond.
   2. Autumnal loss of leaves in local park area.
   3. Construction of model showing coriolis effect.
   4. Erosion in a new housing development.
   5. Pollution of local streams.
   6. Soil depth-temp correlations.
   7. Study of local water tables.
   8. Student suggestions.

(Continued)

SUGGESTED RESOURCES	CONTINUED OR ADDED LEARNING ACTIVITIES
Publications: Modern Earth Science, Holt, Rinehart & Winston, 1969. The Earth: Its Changing Form, Harcourt, Brace & World, 1970. National Wildlife Federation 1412 - 16th Street Washington, D. C. 20036, A host of brochures, pamphlets and magazines. List of publications is free. **Audio–Visual:** **Community:**	Outside Activity: (Continued) D. Reporting methods may include photographs, tables, models, written and oral reports.

E. S. E. A. Title III – PROJECT I–C–E 59–70–0135–4

Environmental:

Integrated with:

CONCEPT NO. 12 - Stewardship

SUBJECT Earth Science

ORIENTATION Pollution

TOPIC/UNIT Energy Resources

BEHAVIORAL OBJECTIVES

Cognitive:

Construct an oil spill and by using his model, will orally describe the safest way of removing the oil from the water.

Affective:

Investigate the problem of pollution in the world's large bodies of water. Form a judgment as to the responsibility of oil companies and ship owners to reduce or eliminate oil as a water pollutant in rivers and lakes.

Skills Used:

1. Gathering information.
2. Note taking.
3. Preparing for discussion.
4. Exhibiting information.
5. Making evaluations.
6. Supporting a position or opinion.

STUDENT–CENTERED LEARNING ACTIVITIES

In-Class:

A. Film: Rocks That Form Underground or charts and teacher discussion.
B. Reading: Modern Earth Science, P. 175-181.
C. Readings from magazines, papers, etc. pertaining to oil pollution.
D. Students, either individually or in groups, will do research of the various aspects of oil, oil production and subsequent pollution and present their views through discussion.
   1. Panel - pros and cons of progress through private ownership as it pertains to pollution of world's oceans.
   2. Study of safer ways of securing oil from ocean deposits.
   3. Better ways of cleaning up affected areas from oil spills.
E. Make displays showing ocean contamination and ways of cleaning these up.
F. Construct a model of ocean area.

(Continued)

Outside or Community:

SUGGESTED RESOURCES

Publications:

Modern Earth Science, C. 1969, Holt, Rinehart & Winston, pp. 175-181.
30 Basic Speech Experiences, Clark Publishing Company.
American Petroleum Institute, free brochures, booklets, etc.
Magazines - various magazines showing oil pollution and results.

Audio-Visual:

Film:
Rocks That Form Underground, Encyclopedia Britannica Films, Inc.

Community:

CONTINUED OR ADDED LEARNING ACTIVITIES

Classroom: (Continued)

F. 1. Could be done on small outside pond.
   2. Large pan or aquarium in the school room.
   3. Use sand for beach.
   4. Small plants.

G. Students will use model for:
   1. Investigation for burning oil out of the water.
      a. Measure temp. of water.
      b. How it affects plant and animal life.
      c. How the fire is contained.
   2. Floating materials around the oil. Some standard methods being used and proposed.
   3. Teacher-approved student ideas for dispersing the oil.
   4. Students may suggest the following:
      a. Chemical action
      b. Agitation of the water
      c. Controlled burning
      d. Wind